

240 TRAFFIC IMPACT ANALYSES

The purpose of this document is to establish uniform guidelines for conducting traffic impact analyses for a proposed new or an expansion of an existing development requesting access, direct or indirect, or modification of access to the State highway system.

A package which includes these guidelines, a Traffic Impact Analysis Study and Report Format Procedural Guidelines, and an Example Traffic Impact Analysis is available from Engineering Records (publication # 35-209).

240.1 IMPLEMENTING STATEMENT

ADOT desires to operate a safe and efficient State highway system. The management of access to the system in an effective manner is vital to maintain the overall safety and efficiency of this system. Access to the State highway system is managed through the encroachment permit process. This permit process requires those desiring access to the State highway system to apply for an encroachment permit. Since access to a State highway for a development may impact traffic on the highway, a Traffic Impact Analysis shall be prepared for developments which desire a permit and meet the specific requirement stated below.

The purposes of the Traffic Impact Analysis procedures presented herein are to:

- Provide information to the permit applicant and/or his representatives on specific requirements of the analysis, and
- Ensure consistency in the preparation and review of Traffic Impact Analyses.

The procedures outlined herein present the minimum information required when conducting a Traffic Impact Analysis. The preparer of the Traffic Impact Analysis shall contact the appropriate ADOT Regional Traffic Engineer to discuss the scope of the analysis, methodology, and level of detail required for his specific project prior to beginning the analysis.

240.2 REFERENCES

ADOT: Traffic Signal Needs Study
 Roadway Design Guidelines

Institute of Transportation Engineers:
 Recommended Practice. Traffic Access and Impact Studies for Site
 Development
 Manual of Transportation Engineering Studies
 Trip Generation
 Transportation and Land Development

Transportation Research Board:
Highway Capacity Manual

240.3 DEFINITIONS

Traffic Impact - The effect of site traffic on highway operations and safety.

Traffic Impact Analysis - A traffic engineering study which determines the potential traffic impacts of a proposed traffic generator. A complete analysis includes an estimation of future traffic with and without the proposed generator, analysis of the traffic impacts, and recommended roadway improvements which may be necessary to accommodate the expected traffic.

Traffic Generator - A designated land use (residential, commercial, office, industrial, etc.) or change in land use that generates vehicular and/or pedestrian traffic to and from the site.

Traffic Mitigation - The reduction of traffic impacts on roadways and/or intersections to an acceptable level of service by way of roadway construction improvements, the upgrade of existing traffic control devices, or the modification of the site plan.

Traffic Generation - The estimation of the number of origins from and destinations to a site resulting from the land use activity on that site.

Mode Split - The estimation of the number of trips made by each mode (automobiles, pedestrian, transit, etc.)

Trip Distribution - The allocation of the site-generated traffic among all possible approach and departure routes.

Trip Assignment - The assignment of site plus non-site traffic to specific streets and highways.

Influence Area - The geographic area surrounding the site from which the development is likely to draw a high percentage (80% or more) of the total site traffic.

Area of Significant Traffic Impact - The geographic area which includes the facilities significantly impacted by the site traffic.

Peak Hour - The single hour of a representative day when the traffic volume on the highway represents the most critical period for operation and the highest typical capacity requirements.

Peak Hour of Generator - The single hour of highest volume of traffic entering and exiting a site.

240.4 REQUIREMENT

A traffic impact analysis shall be required for all new developments or additions to existing developments which generate 100 or more trips during any one hour of a day. The specific analysis requirements and level of detail are determined by the following categories:

- (1) Category I - Developments which generate 100 or more peak hour trips but less than 500 trips during the morning or afternoon peak hour of the highway or during the peak hour of the generator.

A Category I Traffic Impact Analysis may also be required for any of the following reasons:

- a. The existence of any current traffic problems or concerns in the local area such as an offset intersection, a high number of traffic accidents, etc., or
- b. The sensitivity of the adjacent neighborhoods or other areas where the public may perceive an adverse impact, or
- c. The proximity of proposed site driveways to existing driveways or intersections, or
- d. Other specific problems or safety concerns that may be aggravated by the proposed development.

- (2) Category II - Developments which generate more than 500 trips during the morning or afternoon peak hour of the highway or during the peak hour of the generator.

The Regional Traffic Engineer makes the final decision on requiring a Traffic Impact Analysis and determining whether the Analysis falls within Category I or II. A developer shall first estimate the number of vehicle trips generated by the development to determine if a Traffic Impact Analysis is required and the applicable category. The developer shall obtain concurrence from the Regional Traffic Engineer on the number of trips generated by the development. The developer may request that the Regional Traffic Engineer assist him in estimating the number of trips for the purpose of determining whether a Traffic Impact Analysis is required for the proposed development.

If a developer agrees to perform mitigation improvements as outlined by the Regional Traffic Engineer, preparation of a Traffic Impact Analysis may be waived.

240.5 ANALYSIS APPROACH AND METHODS

The following diagrams shall illustrate the roadway network accurately and shall be included in each Traffic Impact Analysis report:

- a. Site location
- b. Site plan
- c. Existing peak hour turning volumes
- d. Estimated site traffic generation (a table may be substituted)
- e. Directional distribution of site traffic
- f. Site traffic assignment (For each horizon year/Build out)
- g. Future traffic assignment without development for each horizon year
- h. LOS for future traffic without development for each horizon year
- i. Total future traffic, i.e. future traffic with development, for each horizon year
- j. LOS for total future traffic for each horizon year

The following items should be documented:

- a. Existing transportation system
- b. Anticipated transportation system
- c. Collision diagram(s)
- d. Recommended improvements

For Category I, many of the items may be documented within the text. For Category II, the items should be included in figures and/or tables. All figures and tables shall be legible.

Additional diagrams may be required to illustrate development construction phases and proposed alternatives when applicable.

When transportation planning models are used to generate present and/or future traffic conditions, it is the responsibility of the submitter to illustrate the diagrams above to provide a clear, step-by-step analysis.

The traffic analysis approach and methods are presented below.

(1) Study Area

The minimum study area shall be determined by project type and size in accordance with the criteria in Table 240-1. The extent of the study area may be enlarged or decreased depending on special conditions as determined by the Regional Traffic Engineer.

(2) Study Horizon Years

The study horizon years shall be determined by project type and size in accordance with the criteria in Table 240-1.

TABLE 240-1
CRITERIA FOR DETERMINING STUDY REQUIREMENTS

Analysis Category	Development Characteristic (d)	Study Horizons (a)	Minimum Study Area On the State Highway(s) (c)
I	Small Development < 500 peak hour trips	1. Opening year	1. Site access driveways 2. Adjacent signalized intersections and/or major unsignalized street intersections
II a	Moderate, single phase 500 - 1000 peak hour trips	1. Opening year 2. 5 years after opening	1. Site access driveways 2. All State highways, signalized intersections, and/or major unsignalized street intersections within 1/2 mile
II b	Large, single phase > 1000 peak hour trips	1. Opening year 2. 5 years after opening (b) 3. 10 years after opening	1. Site access driveways 2. All State highways, signalized intersections, and/or major unsignalized street intersections within 1 mile
II c	Moderate or large, multi-phase	1. Opening year of each phase 2. 5 years after opening (b) 3. 15 years after opening	1. Site access driveways 2. All State highways, signalized intersections, and major unsignalized street intersections within 1 mile

- (a) Assume full occupancy and build-out.
- (b) Not required if the traffic impacts of the project are fully mitigated 10 or 15 years after opening with existing conditions plus 5-year programmed improvements.
- (c) An enlarged study area may be required by the Region for certain projects.

- (d) The number of trips shall include all trips made to the site, i.e. pass-by and diverted link trips.

(3) Analysis Time Period

Both the morning and afternoon weekday peak hours shall be analyzed except:

- a. If the proposed project is expected to generate no trips or a very low number of trips during either the morning or evening peak periods, then the requirement to analyze one or both of these periods may be waived by the Regional Traffic Engineer, or
- b. Where the peak traffic hour in the study area occurs during a different time period than the normal morning or afternoon peak travel periods (for example midday), or occurs on a weekend, or if the proposed project has unusual peaking characteristics, these additional peak hours shall also be analyzed.

The peak hour of generator also shall be analyzed where its value exceeds the number of trips generated by the development during the peak hour of the adjacent highway.

(4) Seasonal Adjustments

The traffic volumes for the analysis hours shall be adjusted for the peak season, if appropriate, in cases where seasonal traffic data are available and approved by the Regional Traffic Engineer.

(5) Data Collection Requirements

All data shall be collected in accordance with the latest edition of the Institute of Transportation Engineers "Manual of Transportation Engineering Studies" or as directed by the Regional Traffic Engineer.

a. Turning Movement Counts

Turning movement counts shall be obtained for all existing cross-street intersections to be analyzed during the morning and afternoon peak periods and the peak hour of the generator. Turning movement counts may be required during other periods as directed by the Regional Traffic Engineer.

Available turning movement counts may be extrapolated a maximum of two years with the concurrence of the Regional Traffic Engineer.

b. Daily Traffic Volumes

The current and projected daily traffic volumes shall be presented in the report. Available daily count data may be obtained from ADOT and extrapolated a maximum of two years with the concurrence of the Regional Traffic Engineer.

Traffic volume estimates from other approved developments within the study area which are expected to occur during the study horizon years should be obtained from ADOT and presented in the report.

Where daily count data are not available, mechanical counts may be required at the Regional Traffic Engineer's discretion for rural highways where the closest intersection is 1/2 mile or further from the site.

c. Accident Data

Traffic accident data shall be obtained from ADOT for the most current three-year period available.

d. Roadway and Intersection Geometrics

Roadway geometric information shall be obtained including roadway width, number of lanes, turning lanes, vertical grade, location of nearby driveways, and lane configuration at intersections.

e. Traffic Control Devices

The location and type of traffic controls shall be identified.

(6) Trip Generation

- a. The latest edition of the Institute of Transportation Engineers' "Trip Generation" shall be used for selecting trip generation rates.
- b. Other rates may be used with the prior approval of the Regional Traffic Engineer in cases where "Trip Generation" does not include trip rates for a specific land use category, or includes only limited data, or where local trip rates have shown to differ from the "Trip Generation" rates.

(7) Trip Distribution and Assignment

- a. Projected trips shall be distributed and added to the projected non-site traffic on the State highway(s).
- b. The specific assumptions and data sources used in deriving trip distribution and assignment shall be documented in the report.

(8) Capacity Analysis

- a. Level of service shall be computed for signalized and unsignalized intersections in accordance with the latest edition of the "Highway Capacity Manual".
- b. For signalized intersections, operational analyses shall be performed for time horizons up to five years. The planning method will be acceptable for time horizons beyond five years. Analyses may include modifications to the existing signal timing if the study area is within a coordinated signal system; Highway Capacity Manual signal timing methods should not be used for generating signal timing.
- c. Analyses may include an arterial analysis in accordance with the latest edition of the "Highway Capacity Manual".
- d. Peak hour factors used for future conditions shall not exceed 0.90. The following peak hour factors shall be used unless otherwise directed by the Regional Traffic Engineer:

PHF = 0.80 for < 75 vph per lane
PHF = 0.85 for 75 - 300 vph per lane
PHF = 0.90 for > 300 vph per lane

(9) Traffic Signal Needs

- a. A traffic signal needs study shall be conducted for all new proposed signals for the base year. If the warrants are not met for the base year, they should be evaluated for each year in the five-year horizon.
- b. Traffic signal needs studies shall be conducted per ADOT Traffic Manual section on the Traffic Signal Needs Study.
- c. Existing signals adjacent to the development's access to the State highway shall be evaluated for continued signal warrants, phasing, timing, and coordination for each year in the five-year horizon.

(10) Accident Analysis

An analysis of three-years of accident data shall be conducted to determine if the level of safety will deteriorate due to the addition of site traffic.

(11) Queuing Analysis (Category II Only)

A queuing analysis shall be conducted for all turn lanes and ramp termini under stop or signal control within the study area.

(12) Speed Considerations

Vehicle speed is used to estimate safe stopping and cross corner sight distances. In general, the posted speed limit is representative of the 85th percentile speed on the highway and may be used to estimate safe stopping and cross corner sight distances. However, the 85th percentile speeds for some highways are commonly higher than the posted speed limit. Therefore, a speed of 5 MPH over the posted speed limit or the 85th percentile speed, as directed by the Regional Traffic Engineer, should be used to estimate safe stopping and cross corner sight distances for highways with posted speeds of 55 MPH or greater.

(13) Improvement Analysis

The roadways and intersections within the study area shall be analyzed with and without the proposed development to identify any projected impacts in regard to level of service and safety.

- a. Where the highway will operate at arterial level of service C or better without the development, the traffic impact of the development on the highway shall be mitigated to arterial level of service C. Mitigation to level of service D may be acceptable in urban areas of over 50,000 population at the discretion of the Regional Traffic Engineer and with the concurrence of the affected municipality.
- b. Where the highway will operate below arterial level of service C in the horizon year(s) without the development, the traffic impact of the development shall be mitigated to provide the same level of service at the horizon year(s).

(14) Certification

The Traffic Impact Analysis shall be prepared under the supervision of a registered Professional Engineer (Civil). For analyses prepared by persons external to ADOT, the report shall be sealed and signed.

240.6 STUDY AND REPORT FORMAT

(1) Introduction and Summary

- a. Purpose of report and study objectives
- b. Executive summary
 - Site location and study area
 - Development description
 - Principal findings
 - Conclusions
 - Recommendations

(2) Proposed Development

- a. Site location
- b. Land use and intensity
- c. Site plan (readable version shall be provided)
 - Access geometrics
- d. Development phasing and timing

(3) Study Area Conditions

- a. Study area
 - Area of significant traffic impact
 - Influence area
- b. Land use
 - Existing land use
 - Anticipated future development
- c. Site accessibility
 - Existing and future area roadway system

(4) Analysis of Existing Conditions

- a. Physical characteristics
 - Roadway characteristics
 - Traffic control devices
 - Transit service
 - Pedestrian/bicycle facilities
 - Existing transportation demand management
- b. Traffic volumes
 - Daily, morning, and afternoon peak periods (two hours), and others as required
- c. Level of service
 - Morning peak hour, afternoon peak hour, and other as required
- d. Safety
- e. Data sources

(5) Projected Traffic

- a. Site traffic forecasting (each horizon year)
 - Trip generation
 - Mode split
 - Pass-by traffic (if applicable)
 - Trip distribution
 - Trip assignment
- b. Non-site traffic forecasting (each horizon year)
 - Projections of non-site traffic by ADOT may be used. For larger developments and study areas, a more comprehensive method may be required which includes: trip generation, trip distribution, modal split, and trip assignment.
- c. Total traffic (each horizon year)

(6) Traffic and Improvement Analysis

- a. Site access
- b. Level of service analysis
 - Without project including programmed improvements (each horizon year)
 - With project including programmed improvements (each horizon year)
- c. Roadway improvements
 - Improvements programmed by ADOT or others to accommodate non-site traffic
 - Additional alternative improvements to accommodate site traffic
- d. Traffic safety
 - Sight distance
 - Acceleration/deceleration lanes, left-turn lanes
 - Adequacy of location and design of driveway access
- e. Pedestrian considerations
- f. Speed considerations
- g. Traffic control needs
- h. Traffic signal needs (base plus each year in five-year horizon)
- i. Transportation demand management

(7) Conclusions

(8) Recommendations

- a. Site access
- b. Roadway improvements
 - Phasing
- c. Transportation demand management actions if appropriate
- d. Other

(9) Appendices

- a. Traffic counts
- b. Capacity analyses worksheets
- c. Traffic signal needs studies
- d. Accident data and summaries

240.7 APPROVALS

The traffic impact analysis shall be submitted to the Regional Traffic Engineer for approval.

The Regional Traffic Engineer or his designated representative shall approve or disapprove the Traffic Impact Analysis.

240.8 DESIGN STANDARD REFERENCE

- A. Designs shall be in accordance with or exceed current ADOT Design, Construction, and Traffic Engineering policies, procedures, and standards.
- B. Capacity analyses shall be in accordance with the latest edition of the "Highway Capacity Manual".
- C. Traffic signal needs studies shall be in accordance with the ADOT Traffic Manual section on the Traffic Signal Needs Study.